Original Research Article

Evaluation of IPM modules against major pests of okra, (*Abelmoschus esculentus*.L.) in Saran District, Bihar, India

Abstract :

Experiments were carried out at ten locations of Saran district, Bihar during *kharif* season 2017 with okra crop cv 'Supper green'. The assessment reveled that module (M_4) proved the most effective treatment against okra pest and diseases *i.e.* shoot and fruit borer, *Earias vittella* F., yellow vein mosaic virus, *Bemisia tabaci* (Genn.) and red spider mites, *Tetranychus urticae* Koch in which lowest incidence was recorded as compared to other IPM modules, farmer practices and control plot during 2017. IPM Module III (shoot and fruit borer 7.02% on shoot, 9.87% on fruits, yellow vein mosaic virus 16.25% and red spider mites 3.35% infestation) was next effective against the major pest of okra crop in compression to IPM modules I (shoot and fruit borer 12.24% on shoot, 18.12% on fruits, yellow vein mosaic virus 24.42% and red spider mites 9.05% infestation), respectively. Significantly, maximum fruit yield was observed in module IV 210.10 q/ha. This was significantly superior over all other module. The impact of various IPM modules showed that net return was also higher in module IV which was Rs.76430.00/ha.

Keywords; IPM modules, Okra, shoot and fruit borer, yellow vein mosaic virus, red spider mites, neonicotinoids

INTRODUCTION:

"Okra (*Abelmoschus esculentus*), also known as lady's finger or bhendi, belongs to family Malvaceae and is an important vegetable crop grown throughout the year in India. Besides India, it is grown in many tropical and subtropical parts of the world. India grows okra on about 4.52 lakh hectares with an annual production of 48.03 lakh tons and productivity of 10.61 t/ha. The productivity of our country is low compared to other countries due to yield losses caused by insect pests, diseases and nematodes. The crop is attacked by more than 72 insect pests and infests the crop from seedling to harvest stage" (Kedar *et al.*, 2014). Amongst various insect-pests causing damage, shoot and fruit borer, Earias *vittella* F. (Lepidoptera : Noctuidae), yellow vein mosaic virus (YVMV) transmitted by whitefly, *Bemisia tabaci* (Gen) and red spider mites, *Tetranychus urticae* Koch are considered as the most limiting factors (Rawat and Saha, 1973; Alagar and Sivasubramanian, 2006). "The excessive and indiscriminate use of pesticides to control these pests has resulted in undesirable ecological changes" (Mahapatra and Gupta, 1998). In light of the aforementioned, it would seem that the best course of action would be to evaluate and implement the IPM module in a holistic approach, making

careful use of recently developed modern pesticides. Hence, the present investigation to assessment of the effectiveness of different IPM modules in Saran district of Bihar.

Materials and Methods:

On farm trial (OFT) was carried out at ten different farmer's field (replication) of near Krishi Vigyan Kendra, Manjhi, Saran, Bihar, under Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar in 2017. The trials were laid out in randomized block design with ten replications. Okra "Supper green" was sown in first week of July with spacing 45 x 30 cm. All the agronomical practices recommended to raise the good crops were followed. Observations were made on ten leaves were randomly selected (yellow vein mosaic virus transmitted by whitefly, *Bemisia tabaci* (Gen) and red spider mite) at fortnightly intervals after 50 days of transplanting. Observation were also recorded by counting healthy fruit and damaged of shoot and fruits for shoot and fruit borer insect at each picking and their weight were noted. The weight of healthy and infested fruits was measured separately, and the percentage infestation was calculated. The percentage infestation and its reduction as a result of various modules were converted to 'Arcsine' before being subjected to analysis of variance. Yield data from various IPM modules were also collected. Finally, in the last week of October, the crop was harvested.

IPM module I : Untreated

IPM module II : Farmers practice

i) Spraying of imidacloprid 0.5 ml/l water once at 30 days after sowing.

ii) Application of quinalphos @ 2 ml/l water 2 to 3 time at 10-15 days interval started 65-90 days after sowing.

IPM module III

i) Deep summer ploughing

ii) Seed treatment with imidacloprid 70% WS @ 10g /kg of seeds

iii) Use of neem cake @ 250kg/ha before transplanting

iv) Spraying of spinosad @ 0.4 ml/l water 40 and 50 days after transplanting.

v) Spraying of abamectin @ 1 ml/l water between 60 and 70 days after transplanting.

IPM module IV

i) Deep summer ploughing

ii) Seed treatment with imidacloprid 70% WS @ 10g /kg of seeds

iii) Use of neem cake @ 250kg/ha before transplanting.

iv) Hand picking and destruction of infested leaves, shoots and fruits of shoot and fruit borer and mite infested leaf at initial stage upto 35 days .

v) Spraying of indoxacarb @ 0.4 ml/l water 45 and 60 days after transplanting.

vi) Spraying of hexythiazox (acaricides) @ 0.5 ml/l water between 70 and 85 days after transplanting.

Results and Discussion:

The result revealed that impact of IPM modules as compared to farmers' practices and untreated plot are presented in Table 1 and 2 during 2017. The incidence of shoot and fruit borer varies from 5.85 per cent to 12.24 per cent during 2017 in vegetative stage. The module IV showed lowest shoot damage *i. e.* 5.85 per cent followed by module III 7.02 per cent shoot damage was recorded with compared to farmer's practices module II 9.36 per cent and untreated plot module I 12.24 per cent. Module IV was observed significantly superior to module II and module I. Similarly, fruit damage was higher in IPM modules I 18.12 per cent and modules II 14.86 per cent with compared to modules III 9.87 per cent and modules IV 7.25 per cent, respectively. The study revealed that module IV was significantly superior to module II and module I.

Almost same trend was recorded in per cent incidence of yellow vein mosaic virus and red spider mites. The incidence of yellow vein mosaic virus was higher as compared to shoot and fruit borer damage which varied from 14.04 per cent module IV to 24.42 per cent in module I, but red spider mites was lowest in module IV which was only 1.89 per cent and highest in module I *i.e.* 9.05 per cent. The data recorded on incidence of shoot and fruit borer, yellow vein mosaic virus and red spider mites during field trials in various IPM modules recorded that module IV significantly reduced the entire pest and demonstrated its superiority.

The yield data, gross return cost of cultivation, net return and benefit cost ratio due to adoption of different IPM modules were also worked out. The fruit yield various from 132.50 q/ha to 210.10 q/ha in during 2017. The maximum mean fruit yield was found in module IV *i.e.* 210.10 q/ha, which was significantly superior over all IPM modules. The mean gross return obtained from 99375 Rs/ha to 157575 Rs/ha in various IPM modules. However, mean cost of cultivation was higher in module IV which was 81145 Rs/ha followed by module III 79825 Rs/ha. Though cost of cultivation was higher in module IV) but net return was maximum is

76430 Rs./ha in comparison with module I *i.e*. 39090 Rs/ha and mean cost benefit ratio was also found maximum in module IV *i.e*. 0.94 followed by module III 0.90, module II 0.85 and module I 0.65, respectively.

In general, the incidence of shoot and fruit borer, yellow vein mosaic virus and red spider mites was minimum and fruit yield was significantly higher in module IV. It might be because of the influence of hand picking and destruction of infested leaves, shoots and fruits, seed treatment with imidacloprid, application of indoxacarb, hexythiazox, deep summer ploughing and use of neem cake @ 250 kg/ha before sowing. The findings demonstrated that neonicotioids insecticides, when applied in modules together with other IPM tactics, provided excellent management from shoot and fruit borer, yellow vein mosaic virus, and red spider mites and received higher yield in comparison to other insecticides like quinalphos.

The study conducted by Kodandaram *et al.,* (2010) suggests that "because of the relatively low risk to non-target organism and environment, high target specificity and their versatility in application methods, neonicotinoids are more useful". Preetha and Nadarajan, (2007), Singh *et al.,* (2008) at Jaipur, Rajasthan and Singh *et al*., (2010) revealed that "imidacloprid and indoxacarb treated okra crop showed maximum reduction in incidence of shoot and fruit borer and yellow vein mosaic virus and received higher yield as compared to other insecticides like quinalphos". Satpathy *et al*., (2010) suggest that a good control of okra pest for seed treatment and seedling root dip is 0.02-0.03 per cent solution of imidacloprid. Campos and Omoto (2002) reported that "widely used in controlling many phytophagous mites in vegetable crops".

Conclusion:

On the basis of the results of on farm trials, it may be concluded that IPM module IV has the potential to protect the okra crop from major insect pests and diseases as well as provide better yield and profit as compared to farmer's practices.

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Table 1: Incidence of major pests in different IPM modules conducted in okra crop during kharif 2017

Treatments	Shoot & fruit borer (% infestation) on shoot	Shoot & fruit borer (% infestation) on fruits	Yellow vein Mosaic Virus (% infestation)	Red spider mites(% infestation)	Yield (q/ha)
IPM modules I (Untreated)	12.24 (20.48)	18.12 (25.19)	24.42 (29.61)	9.05 (17.51)	132.5
IPM modules II (Farmers' practices)	9.36 (17.81)	14.86 (22.67)	19.23 (26.01)	6.35 (14.60)	172.7
IPM modules III	7.02 (15.36)	9.87 (18.31)	16.25 (23.71)	3.35 (10.55)	202.4
IPM modules IV	5.85 (14.00)	7.25 (15.62)	14.04 (22.01)	1.89 (7.90)	210.1
SEm±	0.26	0.24	0.35	0.15	1.78
CD 5%	0.90	0.84	1.19	0.53	6.23

Figures in parentheses are the Arc sine

Table 2: Economic viability of different IPM modules in okra crop during kharif 2017

Treatments	Gross return (₹/ha)	Cost of cultivation (₹/ha)	Net return (₹/ha)	Benefit Cost ratio
IPM modules I (Untreated)	99375	60285	39090	0.65
IPM modules II (Farmers' practices)	129525	70175	59350	0.85
IPM modules III	151800	79825	71975	0.90
IPM modules IV	157575	81145	76430	0.94

Not : The selling price of fruit was considered as Rs. 750 per quintal